

國立中央大學八十五學年度碩士班研究生入學試題卷

所別: 光電科學研究所 不分組 科目: 材料工程 共 / 頁 第 / 頁

1. (20%)

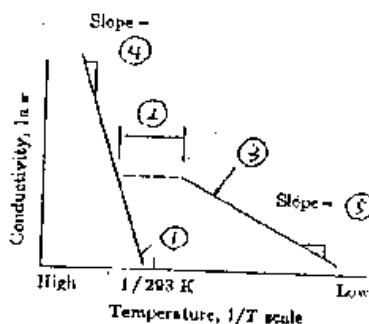
- (a) A metal changes from bcc to fcc at 800 °C. At this temperature the atomic radii of the metal atoms in the two structures are 0.12 nm and 0.125 nm, respectively. What is the percent of volume change as the structure changes?
- (b) A metal has a fcc structure and lattice constant of 0.36 nm. When shining with an x-ray with a wavelength of 0.15 nm, what is the angle 2θ , for the first order diffraction lines of the d_{111} spacings?

2. (20%)

- (a) Describe and discuss the edge dislocation and screw dislocation?
- (b) BaTiO_3 has piezoelectricity. Please draw pictures to show the flow of electrons as applying stress on this material.

3. (20%)

- (a) For impurity doped semiconductor, its conductivity versus temperature is shown as figure, please indicate the appropriate name for three regions (1~3), and write down the slopes for two regions (4~5)?
- (b) To what temperature must germanium be cooled in order for its conductivity to be reduced by a factor of two below its 20 °C? (band gap is 0.7 eV, $k_B = 86.1 \times 10^{-6}$ eV/K)

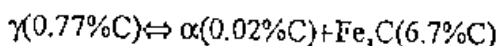


4. (20%)

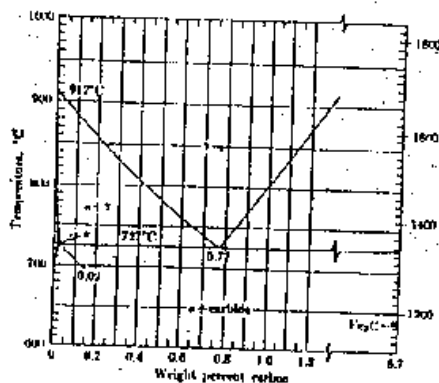
Please describe the following solid-phase reactions: grain growth, recrystallization, polymorphic changes, precipitation, eutectoid reactions and Martensitic transformation?

5. (20%)

For Fe-C system, at 727 °C the specific eutectoid reaction is



- (a) please calculate the amount of ferrite (α) before (728 °C) and after (726 °C) the eutectoid reaction in 100 gram alloy of 0.6% carbon and 99.4% iron.
- (b) What is the pearlite structure? how diffusion speed affect its structure?



The eutectoid region of the Fe-Fe₃C phase diagram.